OSIsoft.

REGIONAL SEMINAR 2012

APAC

The Power of Data

Power Generation – Leveraging Technology to Optimize Operations and Maintenance

Presented by **David Thomason, Business Development Executive (Generation), OSIsoft LLC**

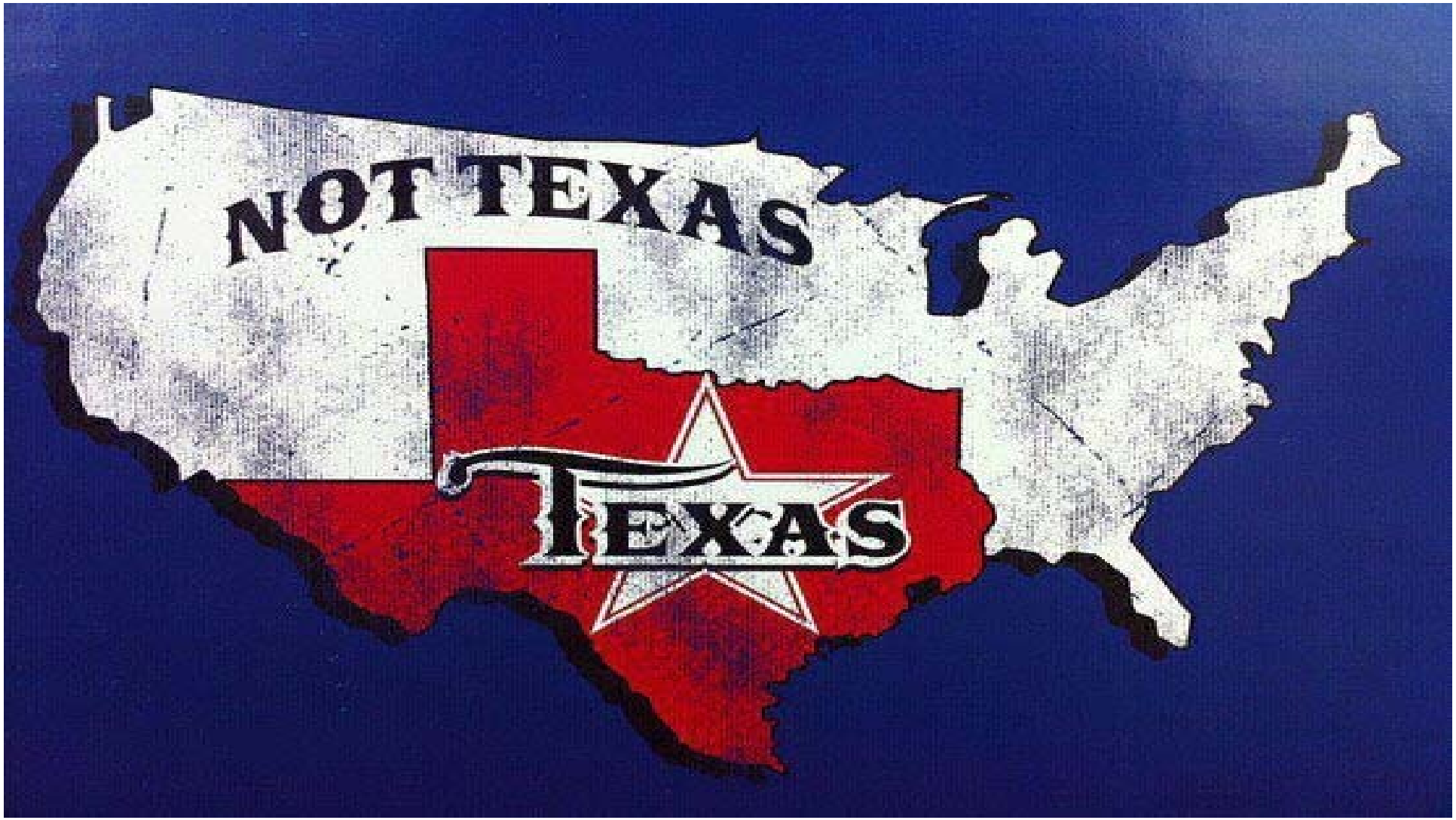
The Power of Data.

OSIsoft - Leveraging Technology to Optimize Operations and Maintenance

August 23rd , 2012

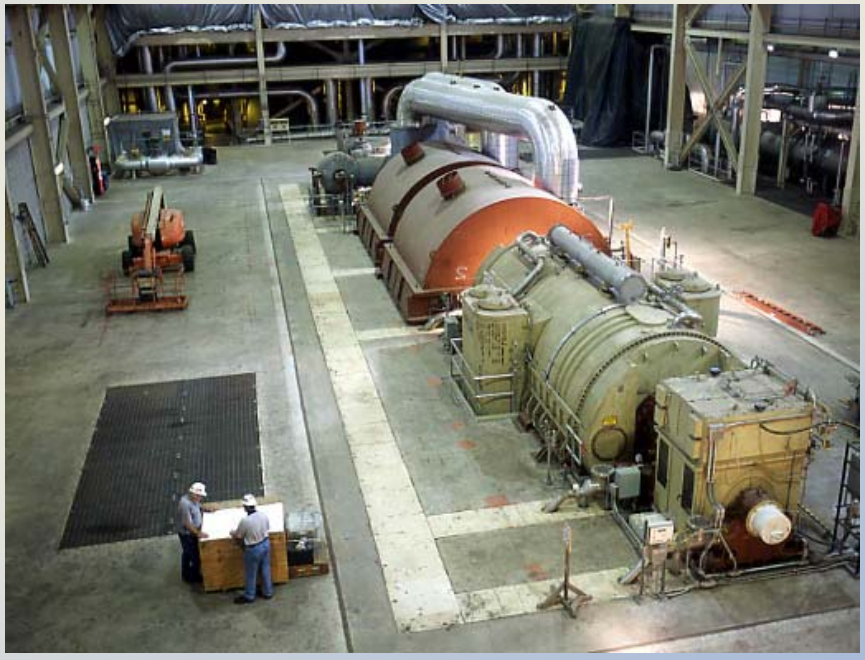
David Thomason
Industry Principal – Global Power Generation




NOT TEXAS
TEXAS

Agenda / Topics

- OSIsoft and Generation
- Proactive Maintenance
- Operations
- APR



Answers from Technology?

No Such Thing as Too Much Information

- **Data Driven Decision Making**
  - **Net gain on Output**
  - **Productivity 5 to 6 % higher**

Reference: Brynfjolfsson, et al., MIT, How does Data-Driven Decision making Affect Firm Performance, 2011.
http://www.nytimes.com/2011/04/24/business/24unboxed.html

PI System

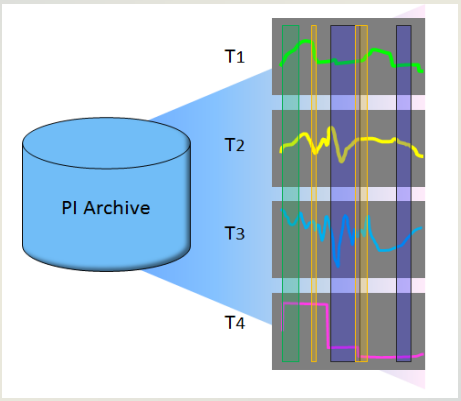
OSIsoft - Addressing Big Data Challenges

Scaling

More data
More updates
More robust

Asset-Centric PI

Manage data via
Asset context –
Reuse many times



Event Frames

Identify and use
important events
and related data

Visualization

Many roles
Different formats
Any device

California ISO – “On the front Lines of the Power Grid” - New York Times, October 2011

PJM – “Information Technology Unleashes the Electric Equivalent of a Free Keystone Pipeline” **-** Forbes - March 2012

Power Industry Challenges

- Power reserve margins are shrinking
  - Retirements of an aging coal fleet
  - Expansion of Shale gas low gas price = low power price
  - Economic conditions impacting new generation investments
- Regulatory Requirements (Security, Carbon, emissions monitoring…)
- Integration of renewables and their variability
- Plant and T&D life extensions and modernization
- Nuclear change in Japan, Germany
- CCGT pushing 60% plus efficiency
- China and India's expanding power use and economy
- Australia's mining boom and importance to keep the beer cold!
- Let's see how the "Power of Data" is helping solve these challenges

Power Generation

Thermal / Fossil Fuels

- Coal
- Gas
- Oil

Nuclear

- Generation
- Fuel
- Regulators
- Services

Renewable Energy

- Wind
- Solar
- Hydro
- Marine
- Bio
- Geo

Power Generation

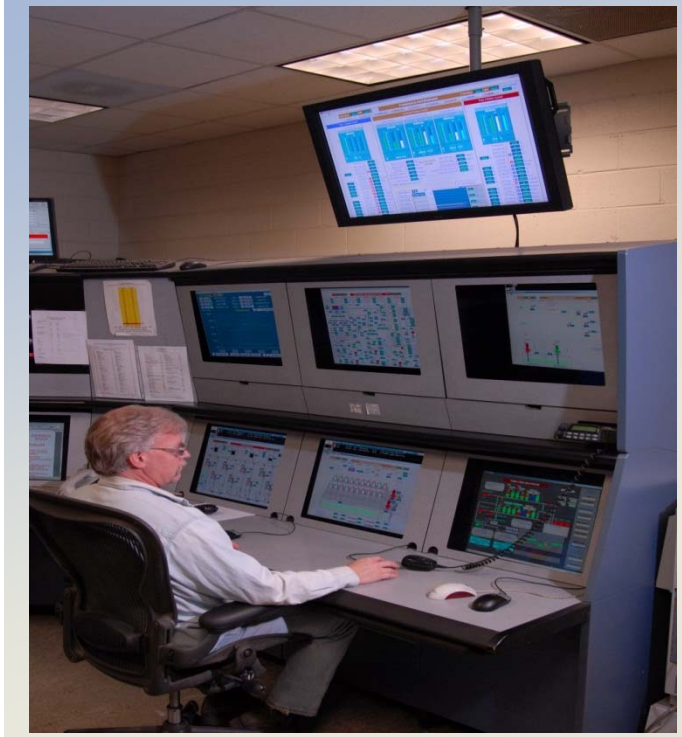
OSIsoft Power and Utilities Experience

Monitored and Optimized with the PI system

- Approximately 60% of USA power generation
- 100% of the ISOs/RTOs in the North America
- 13 of the top 15 wind generating producers in the world
- 19.5GW of total 23 GW USA wind generation
- Over 50% of the Concentrated Solar Plants (CSPs) in the world
- 76% of USA nuclear power generators and the Nuclear Regulatory Commission
- 100% of nuclear power generators in Canada, UK & Korea

The PI System -A "Defacto" Standard in Power Generation

Driving Factors for PI Infrastructure



- Problem: Many disparate plant systems and the need to turn data into actionable information
  - DCS, PLC, CEMS, Analyzers…
  - Various timestamps
  - Data accessibility & integrity
- Solution: OSIsoft, Enterprise Wide Infrastructure
  - Common real-time database
  - Common visualization and analytic toolset
  - Common platform for notifications, development and advanced analytics
  - Leverage SMEs (Central, Plant, Vendors)
  - Remote Monitoring & Diagnostics

Increase availability, lower lost margin

Multi Uses for PI information

- Proactive and Condition Based Maintenance
- Operations (extend DCS beyond the Control Room)
  - Controllable Losses – Start Up / Shut Down
- Root Cause Analysis (RCA)
- Outage Planning (plan and spend on the right things)
- Vendor Performance (Pre and Post work review)
- Equipment / Manufacture Performance
- Plant and System Performance / Efficiency
  - Production vs schedule - Heat rate – Condenser – Turbine - Boiler / HRSG
- Environmental (Compliance, emissions, limits, reporting)
- Water Chemistry and Boilers
- Enterprise view of core metrics and KPIs
- Security (NERC CIP, …) Passive access to Plant information
- Scheduling, Ancillary Services and Dispatch Optimization

Single version of the truth

Proactive Maintenance

- Proactive Maintenance is a strategy in which Corrective, Preventive, and Predictive processes complement one another.
- The average industrial plant performs **more than 55% Reactive** maintenance work. Reactive is the highest cost!
- The top industrial plants perform **less than 10% Reactive** maintenance work. An industry "best practice" target goal maintenance mix

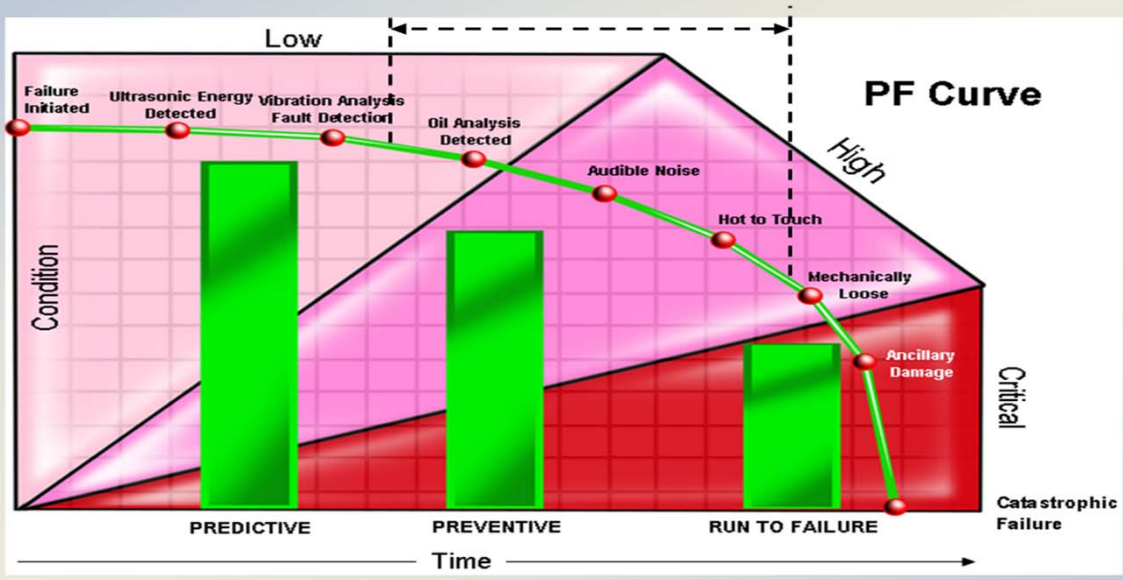
Reactive 10%	Preventive 35%	Predictive 55%
Minimize emergent work	Optimize current PM Practices	Expand existing PdM Applications

- Strategy: enhance & expand the use of real time, historical data and analytics systems

Proactive Maintenance P-F Curve

The P-F curve is to show the behavior of equipment as it approaches failure.

- The P on the curve is the first possible point when equipment degrades or changes can be detected.
- The F is the point of equipment or system failure.
- The time between is your "opportunity" to avoid unplanned events



P-F Interval

Time frame to rectify impending equipment failure (Planning / Scheduling / Execution Window)

Earliest detection provides the greatest opportunity time

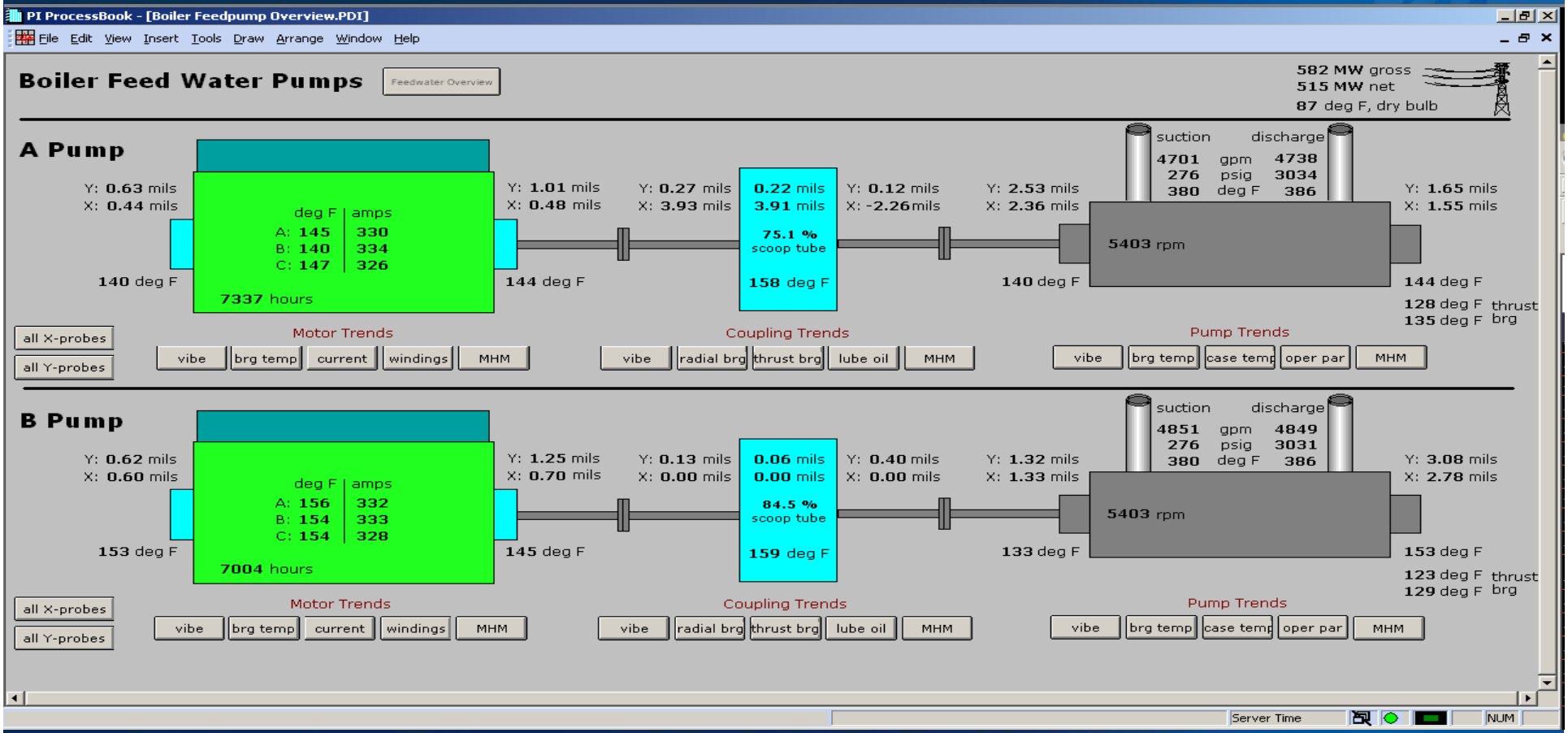
Source: Allied Reliability

12

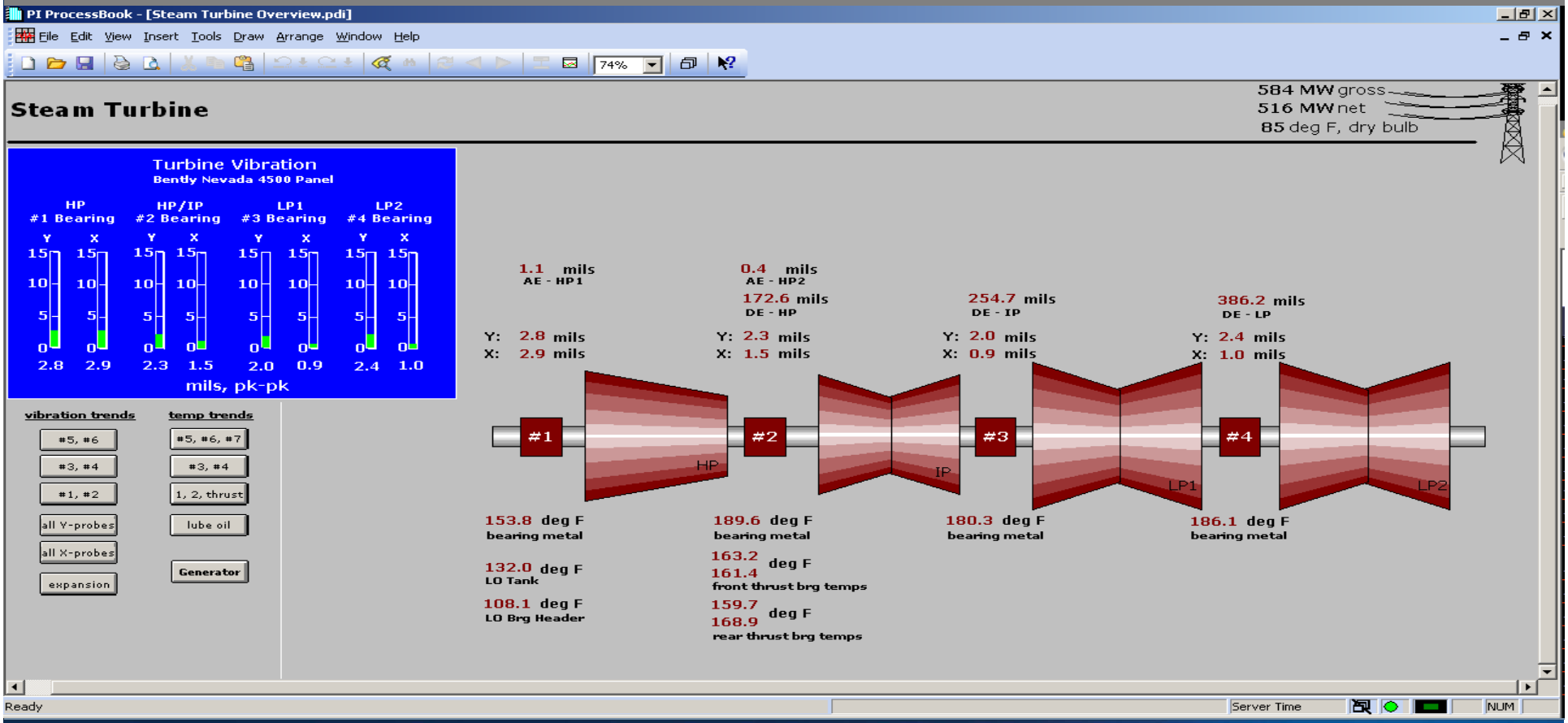
Proactive Maintenance

- Screens and information with Maintenance in mind
- A focus on critical equipment, parameters for condition
  - Vibrations (rotating equipment, motors, pumps, turbine…)
  - Temperatures (bearings, oil, metal, motors…)
  - Amps
- Transform data and use in a new, valuable way
- Use out of the box, PI System functionality
  - Totalizers for run time counters, compare / balance usage, schedule maintenance, measure accumulative damage
  - Multi-state graphics
  - Notifications
- Increase speed and accuracy of decisions

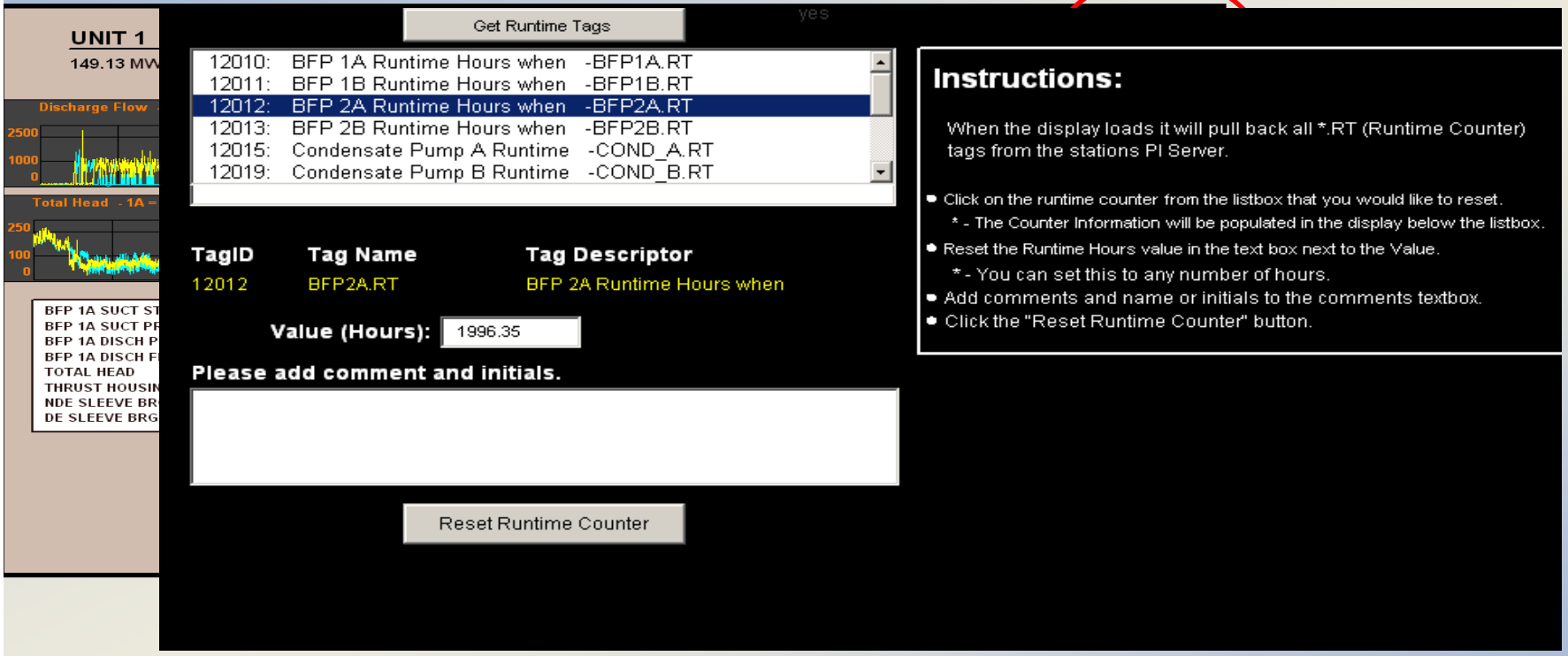
Proactive Maintenance Monitoring



Proactive Maintenance Monitoring



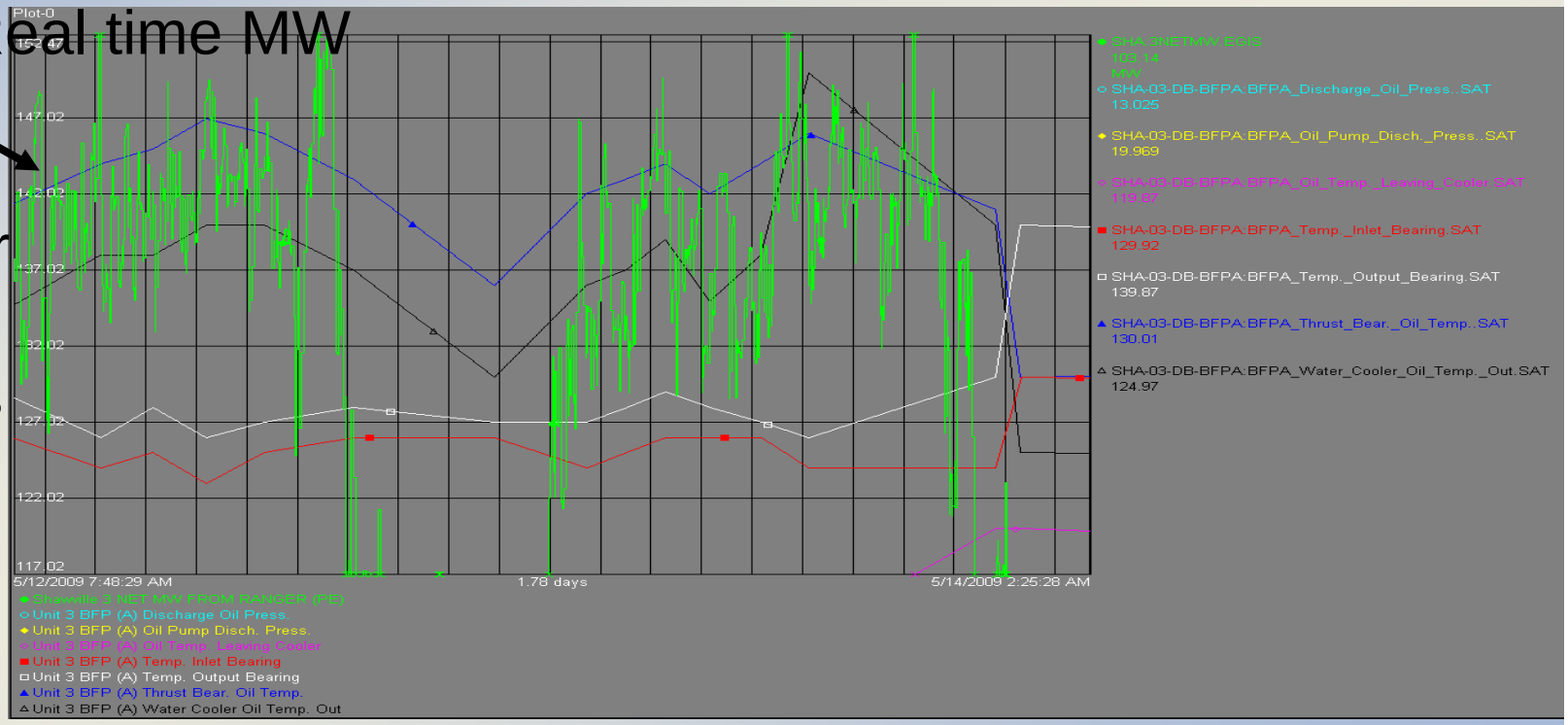
Condition Based Maintenance Screens



Manual Round Data Correlation

Green = Real time MW

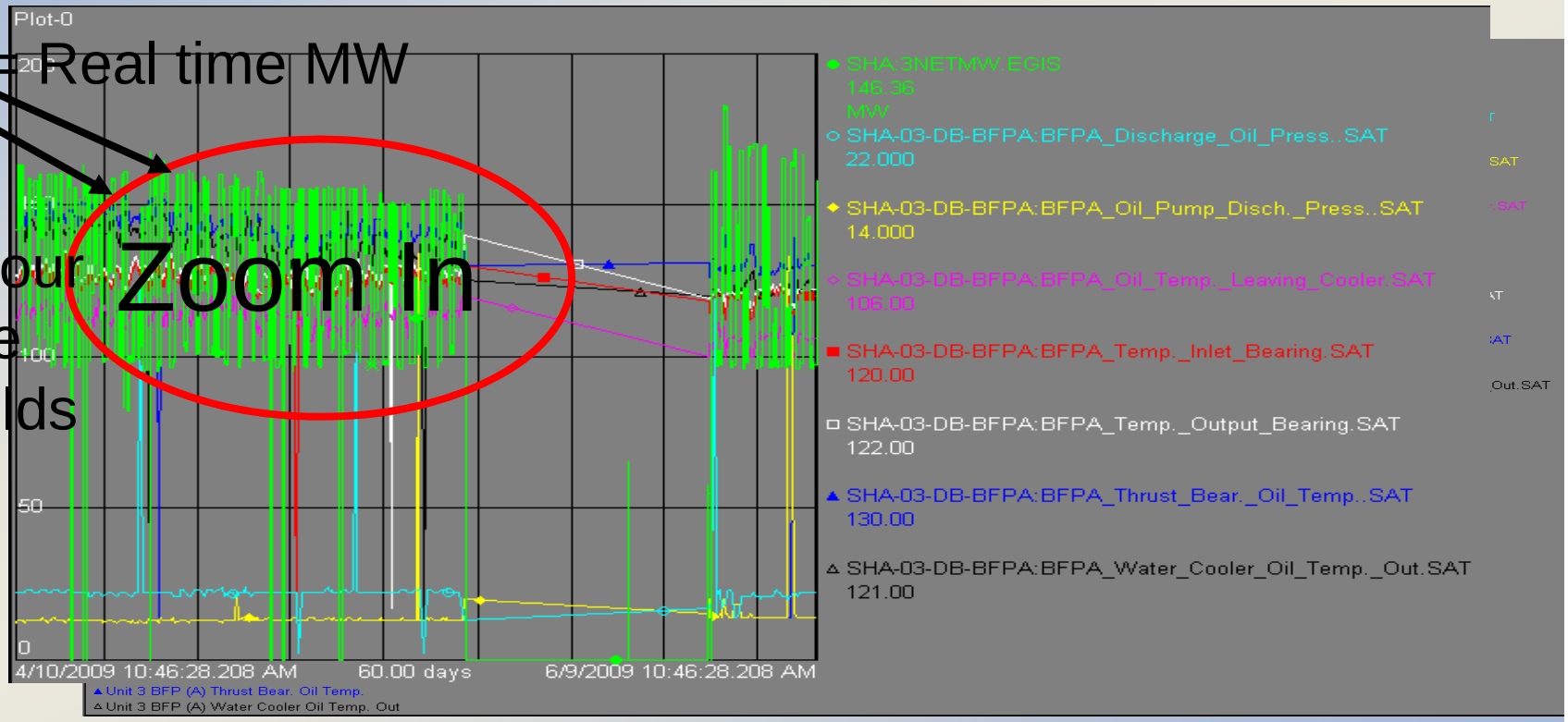
Data Taken every hour from the handhelds



Manual Round Data Correlation

Green = Real time MW

Data Taken every hour from the handhelds



Boilers – Highest Loss Margin System

"The race car tire of Power Generation"
Most outages / de-rates are boiler related

- Transformation of data to useful information

Water Chemistry

- Improve and interface to analyzers
- Cycle Water Chemistry screens
- Calculate minutes in / out of spec
- Notifications on limits
- Make visible via PI system

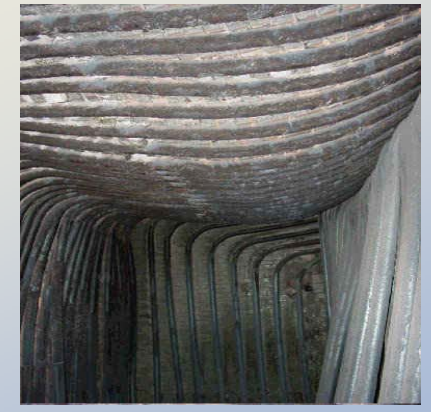
Transform and use data in a new way…

Boilers – Highest Loss Margin System

Boiler Tubes Temperatures

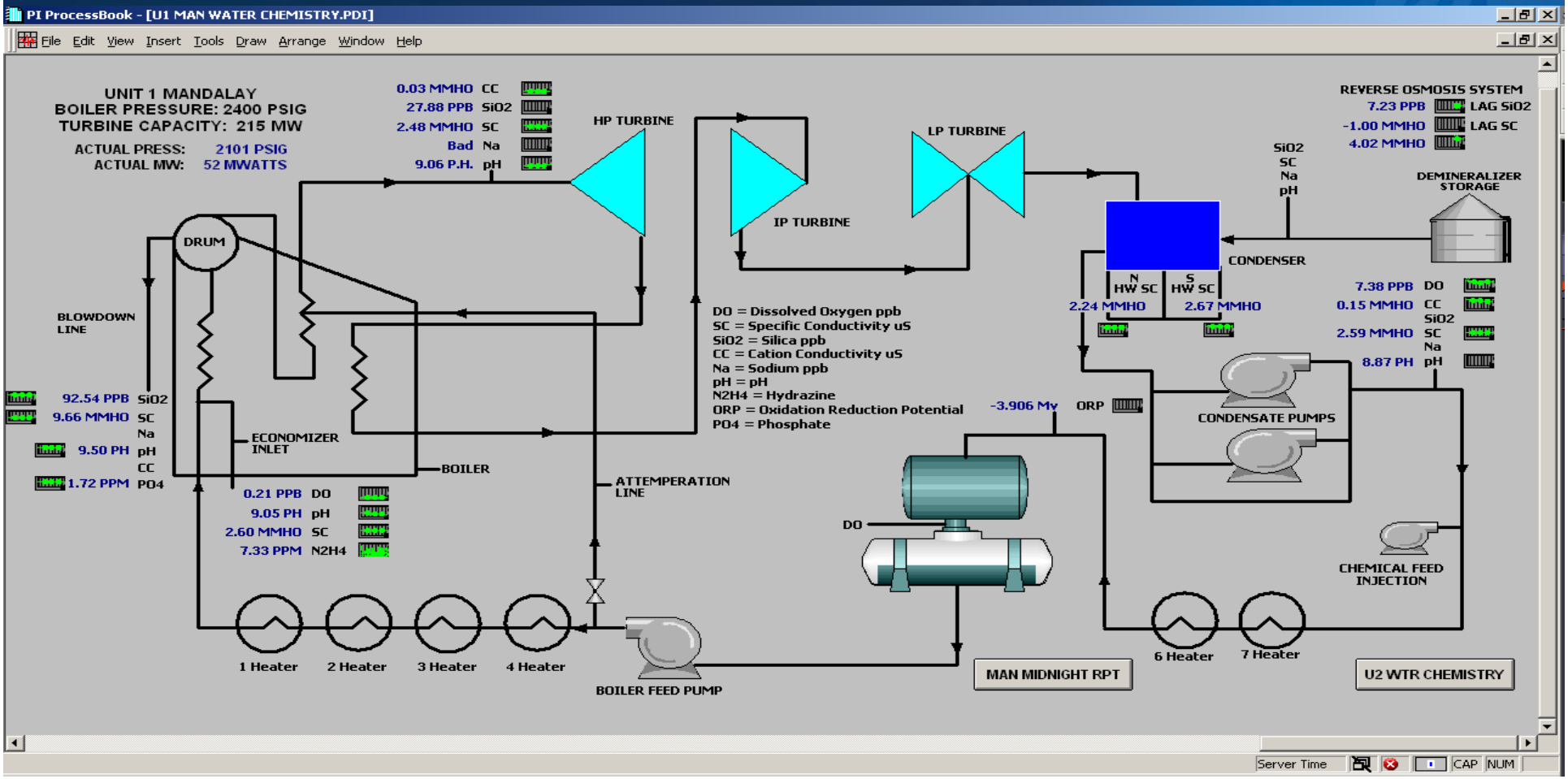
Systematically track:

- How many excursions?
- Length of excursions?
- Total time out of specification…
- Maintain instrumentation!



Transform and use data in a new way…

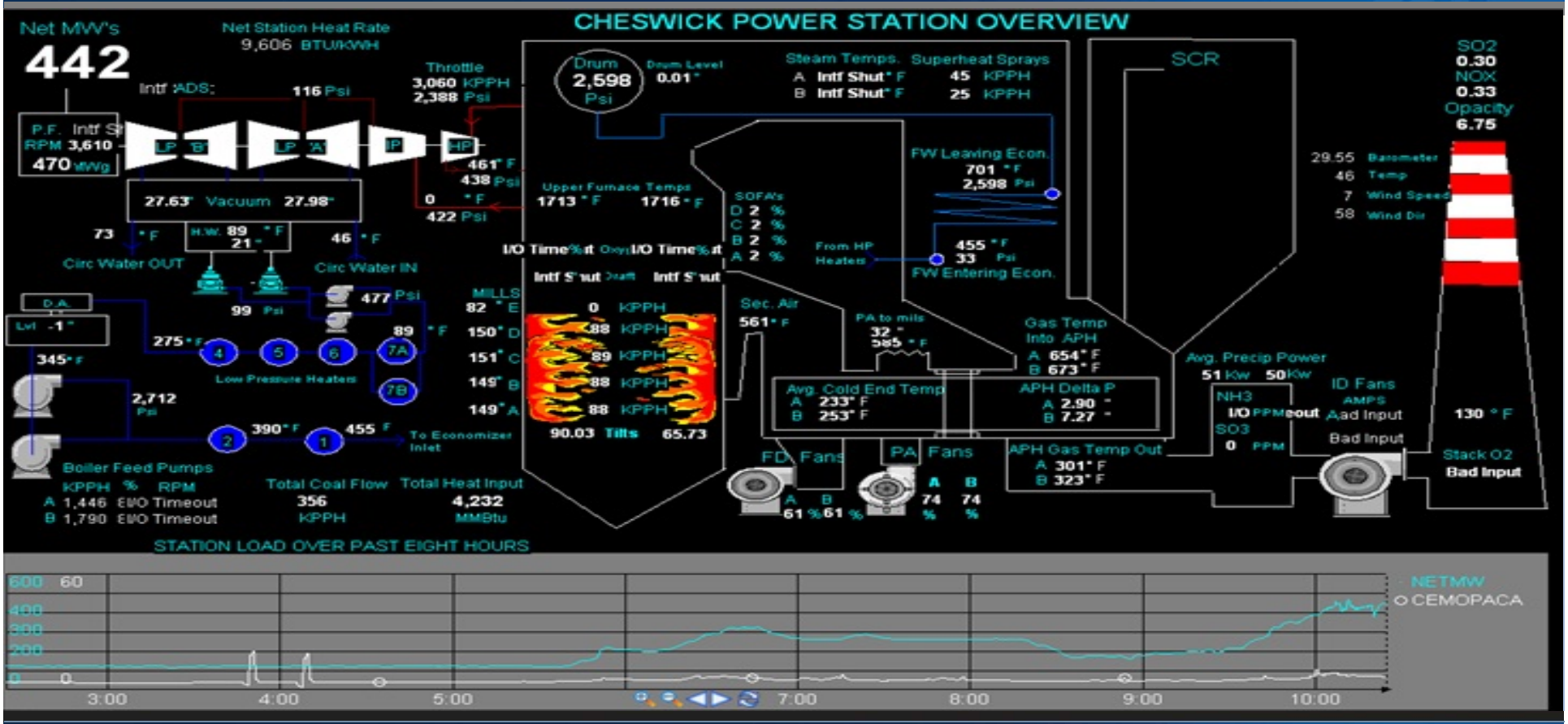
Water Chemistry Displays



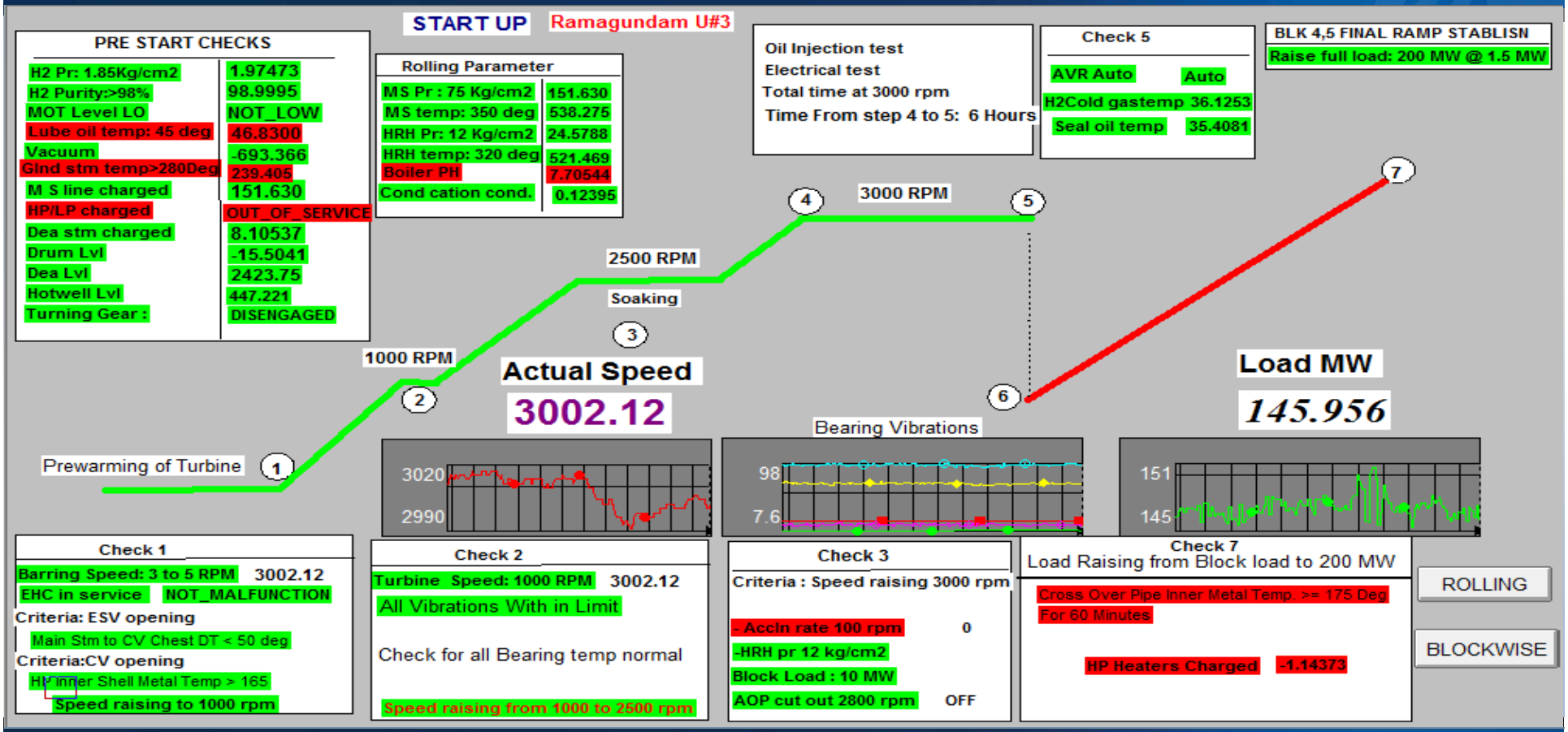
Water Chemistry - Reports

PARAMETERS:	EXPECTED RANGES	UNIT 1							
		MIN FOR DAY	AVG FOR DAY	MAX FOR DAY	MINS IN NORMAL	MINS IN ACTION LVL 1	MINS IN ACTION LVL 2	MINS IN ACTION LVL 3	MINS IN ACTION LVL 4
Condensate Pump Discharge									
pH	9.2 - 9.6	9.40	9.43	9.46	1440.00	0.00	0.00	0.00	0.00
CC - CPD A, µS/cm	< 0.2	0.09	0.10	0.11	1440.00	0.00	0.00	0.00	N/A
Dissolved Oxygen, ppb	< 10	2.55	3.03	3.53	1440.00	0.00	0.00	N/A	N/A
Sodium, ppb	< 3	0.09	0.09	0.10	1440.00	0.00	0.00	0.00	N/A
Boiler Feedwater									
pH	9.2 - 9.6	9.31	9.32	9.33	1440.00	0.00	0.00	0.00	0.00
Cation Conductivity, µS/cm	< 0.2	0.04	0.04	0.04	1440.00	0.00	0.00	0.00	N/A
Specific Conductivity, µS/cm	4 - 11	7.86	7.90	7.99	1440.00	0.00	N/A	N/A	N/A
Dissolved Oxygen, ppb	1- 10	8.57	8.99	9.82	1440.00	0.00	0.00	0.00	N/A
Sodium, ppb	< 3	0.12	0.13	0.15	1440.00	0.00	0.00	0.00	N/A
Boiler Water (Drum Blowdown)									
pH - T1Drum Blowdown A	9.2 - 9.6	9.13	9.16	9.21	158.35	1281.65	0.00	0.00	0.00
CC - T1 BLR 1 Water	< 1.0	0.20	0.22	0.24	1440.00	0.00	0.00	0.00	N/A
SC - T1 Drum Blowdown	4 - 11	5.26	5.30	5.38	1440.00	0.00	N/A	N/A	N/A
Silica - T1, ppb	< 60	41.69	44.11	49.17	1440.00	0.00	0.00	0.00	N/A
Sodium - T2, ppb	< 300	3.89	10.22	20.74	1440.00	0.00	0.00	0.00	N/A
Saturate Steam (Drum Steam)									
CC - T1 Drum Steam, µS/cm	< 0.2	0.13	0.14	0.15	1440.00	0.00	0.00	0.00	N/A
Degas CC - T1 Drum Steam, µS/cm	< 0.2	0.09	0.09	0.09	1440.00	0.00	0.00	0.00	N/A
SC - T1 Drum Steam, µS/cm	4 - 11	7.70	10.28	16.36	1027.47	412.53	N/A	N/A	N/A
Silica - T1, ppb	< 10	3.81	4.07	4.83	1440.00	0.00	0.00	0.00	N/A
Main Steam									
Degas Cation Conductivity, µS/cm	< 0.15	0.10	0.10	0.11	1440.00	0.00	0.00	0.00	N/A
Silica, ppb	< 10	4.99	5.51	6.39	1440.00	0.00	0.00	0.00	N/A
Sodium, ppb	< 2	0.11	0.12	0.13	1440.00	0.00	0.00	0.00	N/A

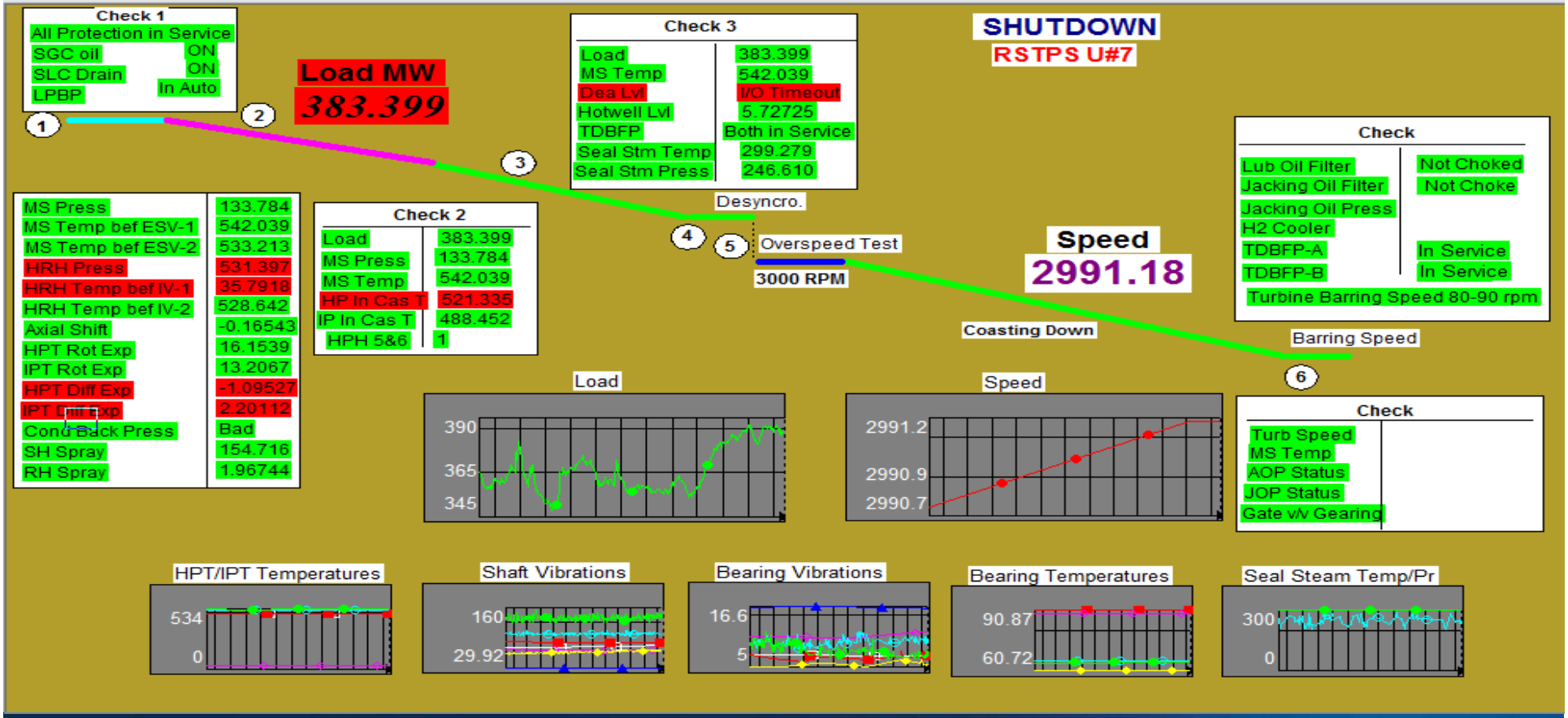
Operations



Non-routine Operations : Start-Up

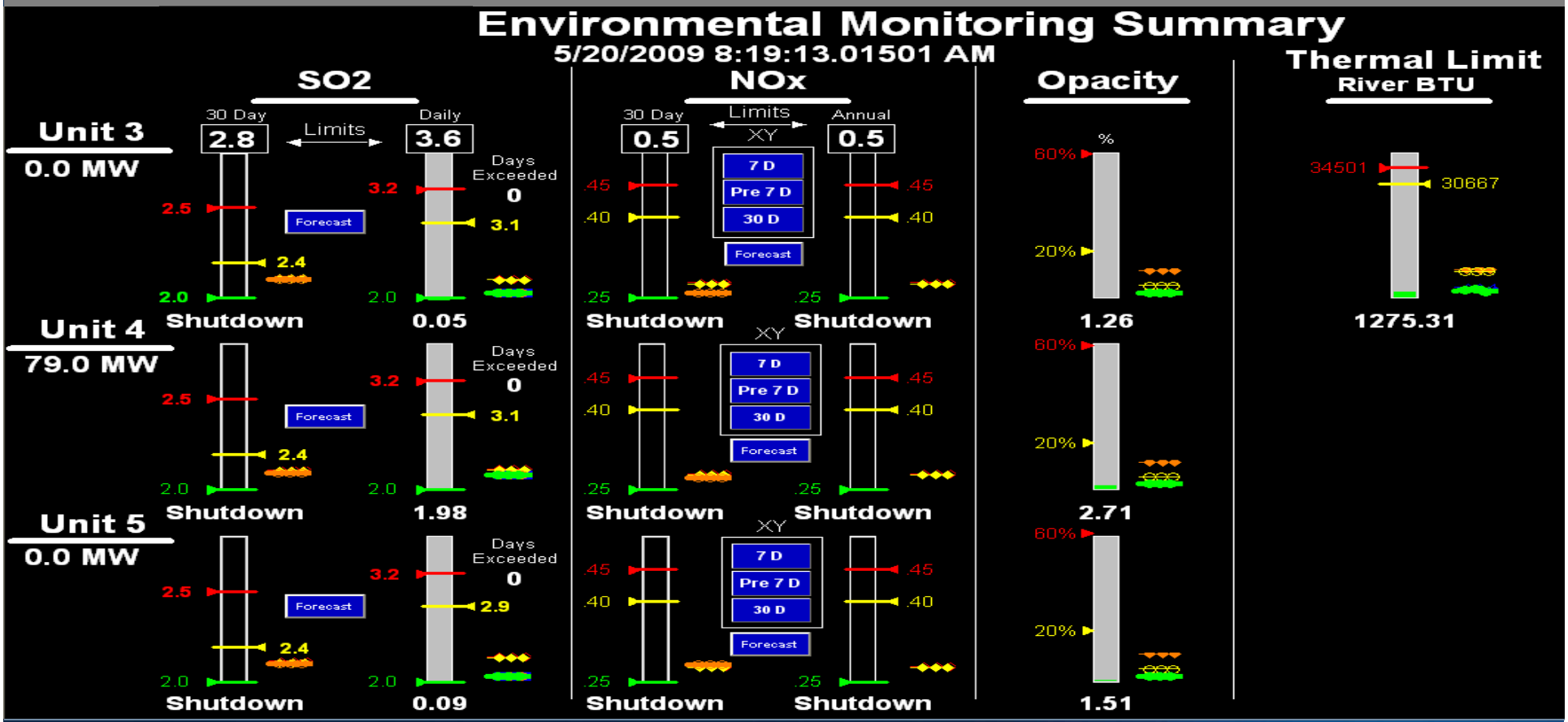


Non-routine Operations : Shut-Down



Operations – Controllable Loss

Environmental Monitoring



Advanced Pattern Recognition (APR) Modeling

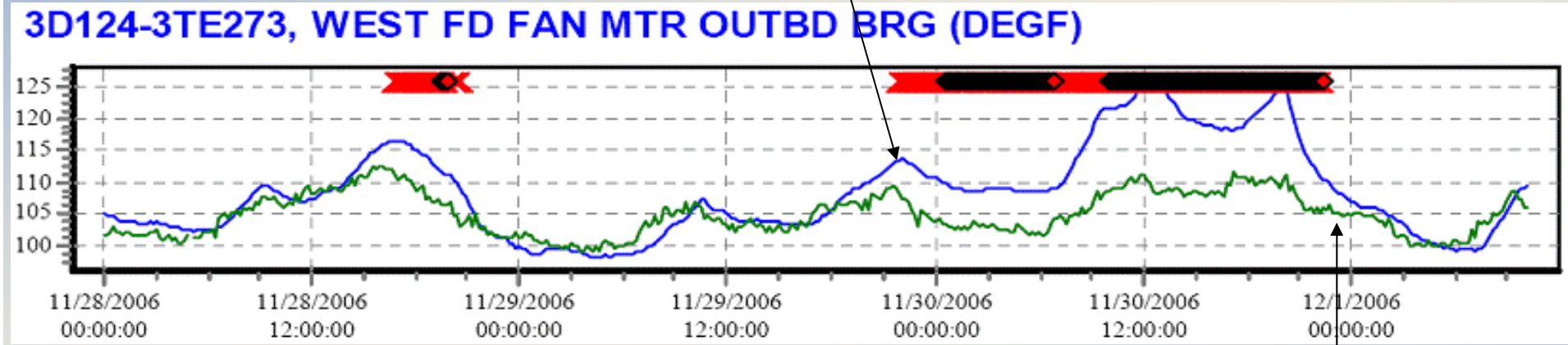
Predictive Analytics leverages the PI system

- *Computers working for you!*
- Reduces Manual Monitoring
- Detects anomalies on critical equipment and systems
- Early detection of slow developing failure
- Multiple sensor models, not just a single signal
  - Avoiding failures
  - Supporting Operations
  - Optimizing Maintenance

Rules based monitoring of critical systems.
Computer models watching the data all the time

Fan Motor Bearing

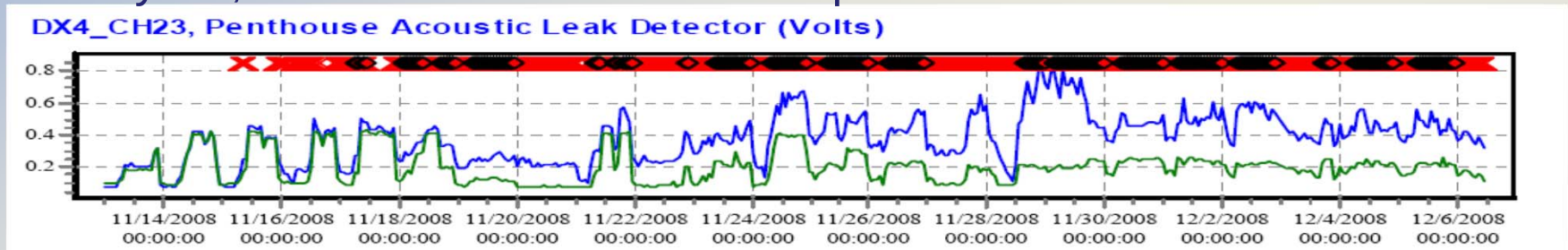
Temperature movement on FD Fan Motor outboard bearing (about 17 degrees above expected currently).



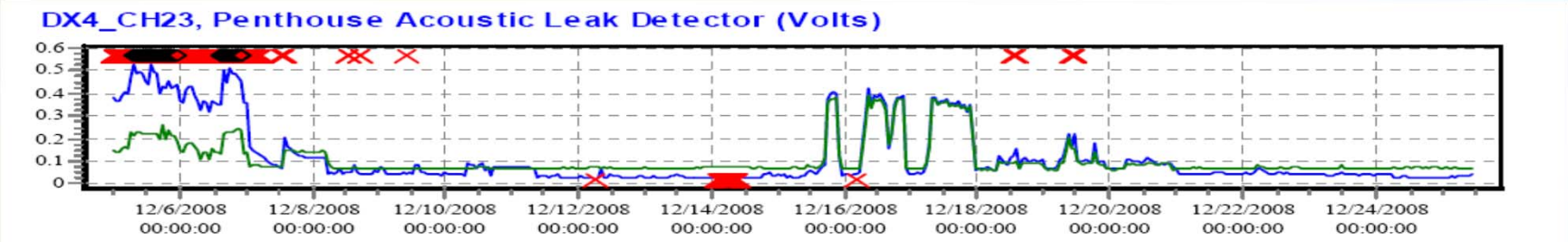
After detection, the filters were found dirty, replaced, and the real time oil level and temps are dropping back to the model expected value.

Correlated Data – “Get everything”

Background: A boiler acoustic detector system was interfaced into PI. A model was created from the new correlated data. Leveraging common notifications and analytics, a leak was detected in unit penthouse.



Resolution: While the unit was offline, a small tube leak was discovered in the penthouse.The leak was repaired, avoiding a potential forced outage.



For Generation...

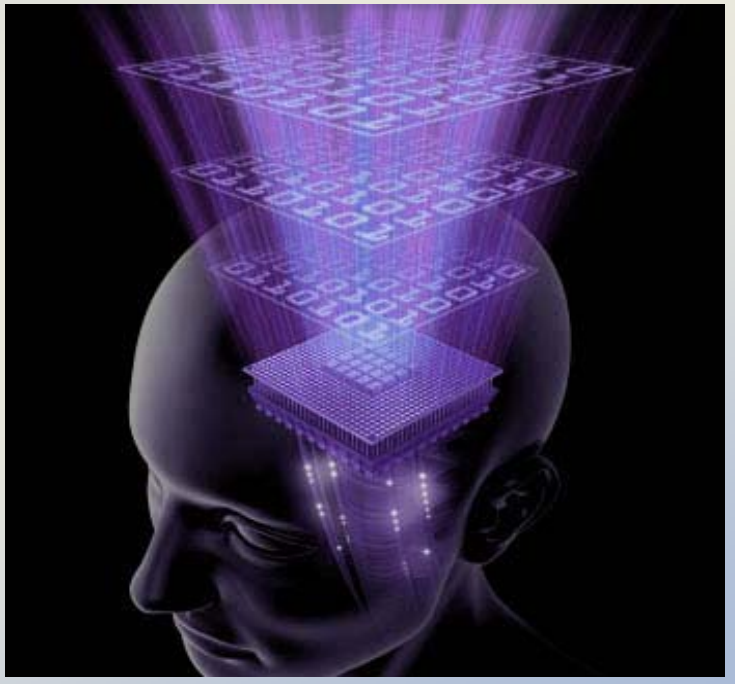
Every OSIsoft PI deployment phase has positive return for Power Generation

Implement a correlated Plant real-time data and event Infrastructure

- *“get everything” at the plant, create a comprehensive, time synched correlated database (DCS, analyzers, vibrations, CEMS, PLCs, weather, mkt prices…)*
- *Make it available… Screens, reports, notifications,…*
- Leverage for core business processes
  - *Operations, Maintenance, and Engineering*
- *Cost effective instrumentation projects*
- *Develop applications and partner solutions*
- *Advanced Analytics*
- *Elevate into KPIs and ERP / EAM Systems*

OSIsoft "Power Of Data"

- All data in real time with context and history
- Decision Making is:
  - Faster
  - More Accurate and Complete
  - More Effective
- Preserve and expand knowledge
- Enable situational predictability
- Increase speed of execution
- Cultivate and leverage the collective "mind" power of the organization



OSIsoft – Fast and Agile

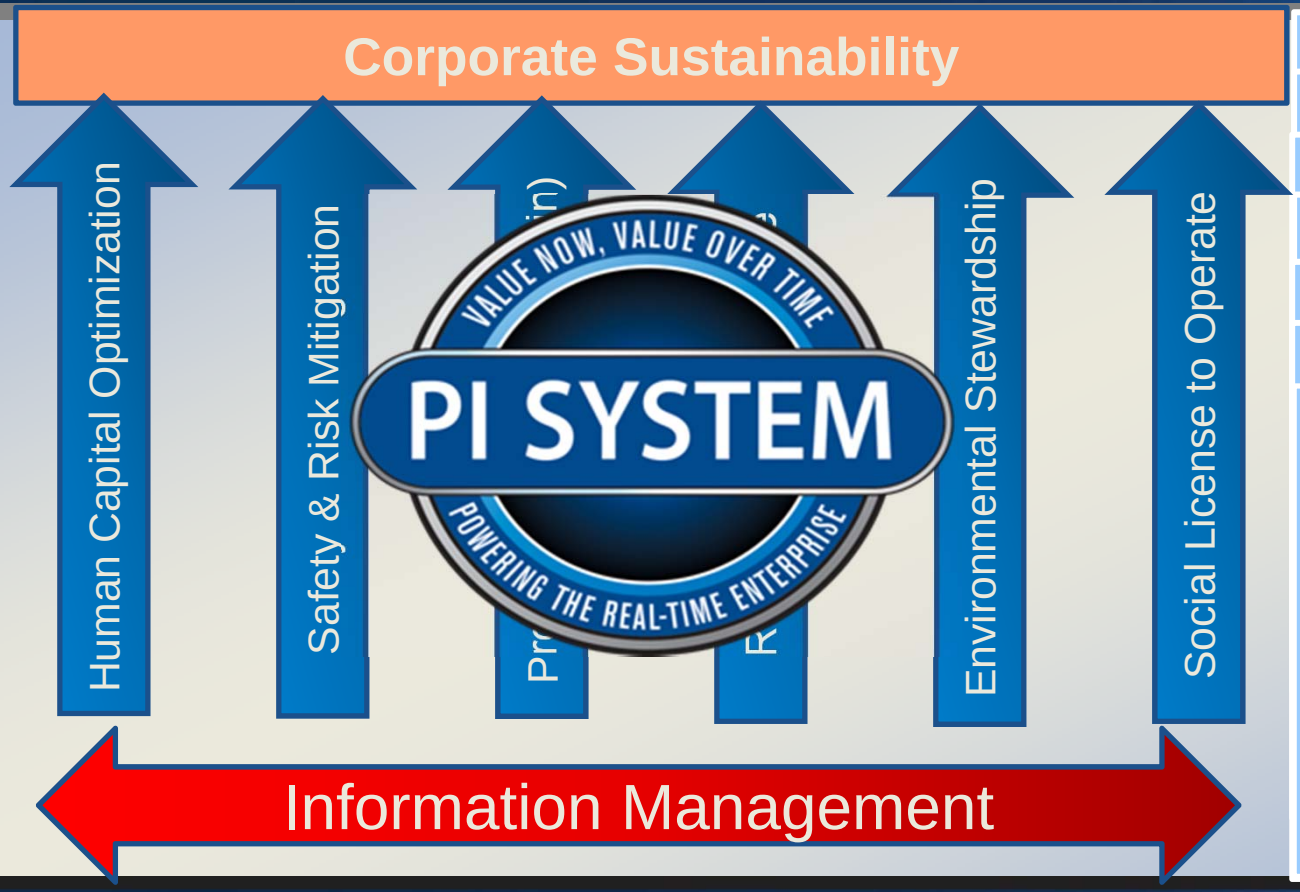
We are here to help!

Thank You and Q&A

Question & Answer

David A. Thomason
OSIsoft, LLC
Business Development Executive – Global Power Generation
phone: 713-858-5585
dthomason@osisoft.com

The 7 Dimensions of Corporate Sustainability



Human Capital Optimization

Safety & Risk Management

Profitability

Regulatory Compliance

Environmental Stewardship

Social License to Operate

Information Management
Underpins all Dimensions

"Timeliness"
Actionable
Quality
Reliability
Security
Governance

THANK YOU

Brought to you by OSIsoft.